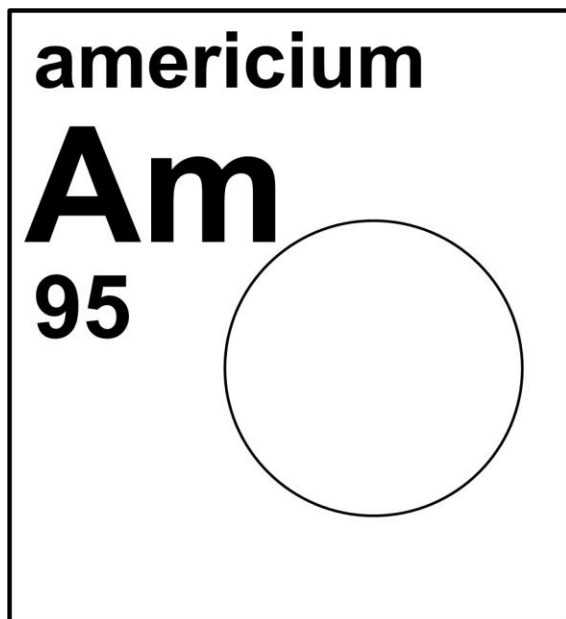





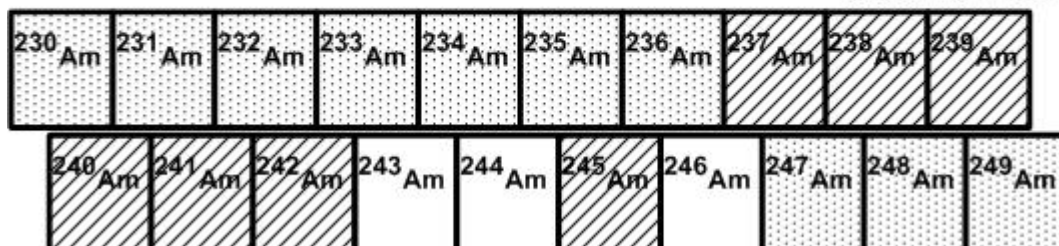
americium



Stable isotope	Atomic mass	Mole fraction
(none)		

Half-life of radioactive isotope

Less than 1 second 
 Between 1 second and 1 hour 
 Greater than 1 hour 



Important applications of stable and/or radioactive isotopes

Isotopes in medicine

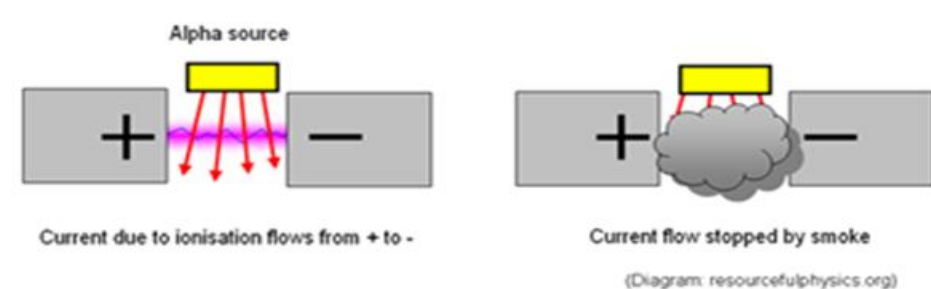
- 1) Gamma ray emissions from ²⁴¹Am can be used as a radiation source for medical diagnostic tests. In particular, ²⁴¹Am helped to provide accurate diagnosis of thyroid function, but this use of americium is now obsolete.

Isotopes in the home

- 1) ²⁴¹Am is used in smoke detectors as an ionization source to detect smoke. A small piece of ²⁴¹americium oxide is inside all smoke detectors. The americium compound gives off alpha particles that strike air molecules in the path causing them to break apart into electrically charged pieces (ions). The ions help carry a current from one side of the detector to the other, flowing continuously when only air is present. The alarm sounds if the current is disrupted by smoke in the detector absorbing the ²⁴¹americium alpha particles resulting in an incomplete circuit.

Smoke detectors in operation

a.



b.

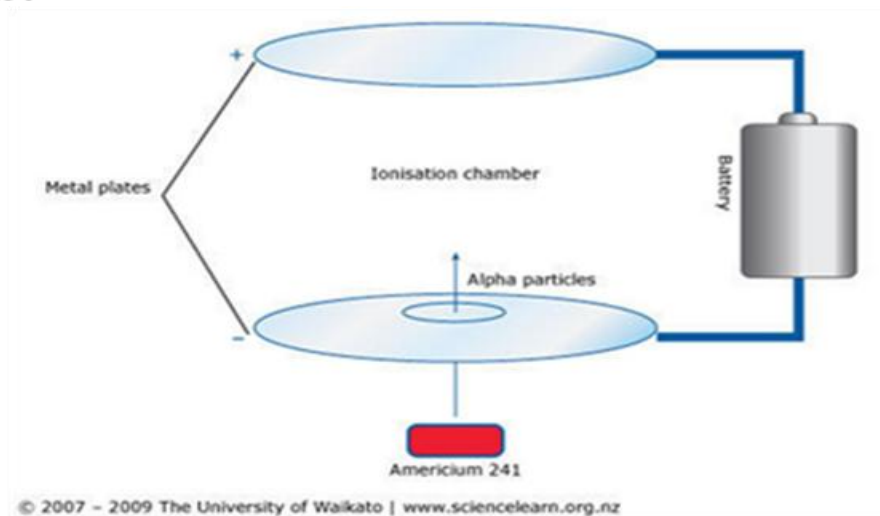


Figure 1a and 1b: Smoke detectors in operation.

Isotopes in industry

- 1) ^{241}Am is used for the control and measurement of industrial material thickness and product quality. In manufacturing, a small piece of ^{241}Am is placed above a conveyer belt and a Geiger counter, (used to count alpha radiation) is placed below the conveyer belt. A certain amount of radiation is expected to register with the Geiger counter. If the product being manufactured, for example glass, is thicker than expected, less radiation will register with the Geiger counter and the product will be rejected.
- 2) ^{241}Am is used in nuclear reactors or particle accelerators as target material in order to produce heavier elements.
- 3) ^{241}Am when mixed with beryllium ($^{241}\text{Am Be}$) emits neutrons at a very high rate. The high rate of neutron generation is useful in oil-well operations to monitor the rate of oil production and also in well logging to log the density of the contents of a well at known depths.

- 4) The gamma radiation of ^{241}Am is also used to in a variety of gauges. Thickness gages, fluid-density gauges, aircraft fuel gauges, and distance-sensing devices use the density measuring capabilities of the emitting gamma rays and radiation detector to function.
- 5) Gamma rays from ^{241}Am are also used as portable X-ray machines to help determine where new wells should be dug. When a small pellet of ^{241}Am is placed in a sealed titanium capsule, it can be used as a portable source for gamma radiography, which is more penetrating than x-rays, to test various materials for defects such as invisible cracks or for checking the welding in pipelines.

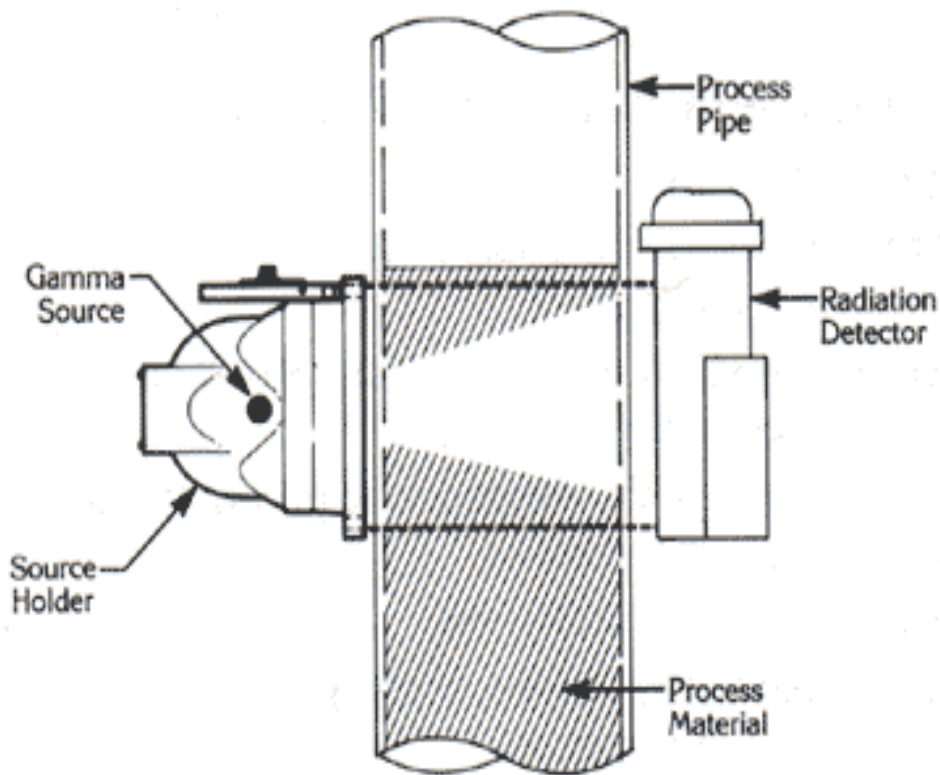


Figure 2: Gauge for density measurement.